Urban Ventilation for Counter Measures for Heat islands towards Quality and Sustainable City Planning in Hong Kong

Towards mitigating urban heat islands in sub-tropical cities

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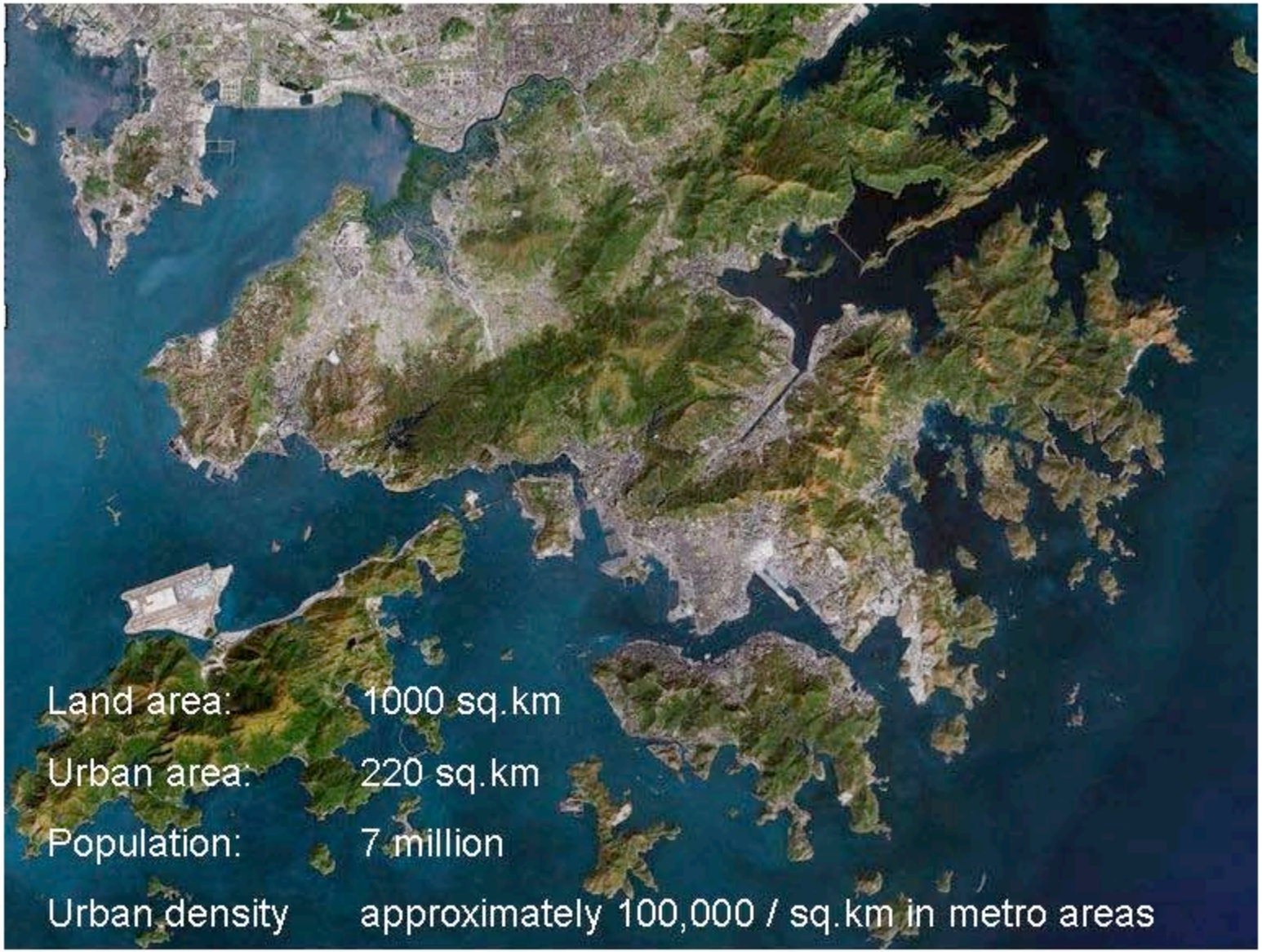
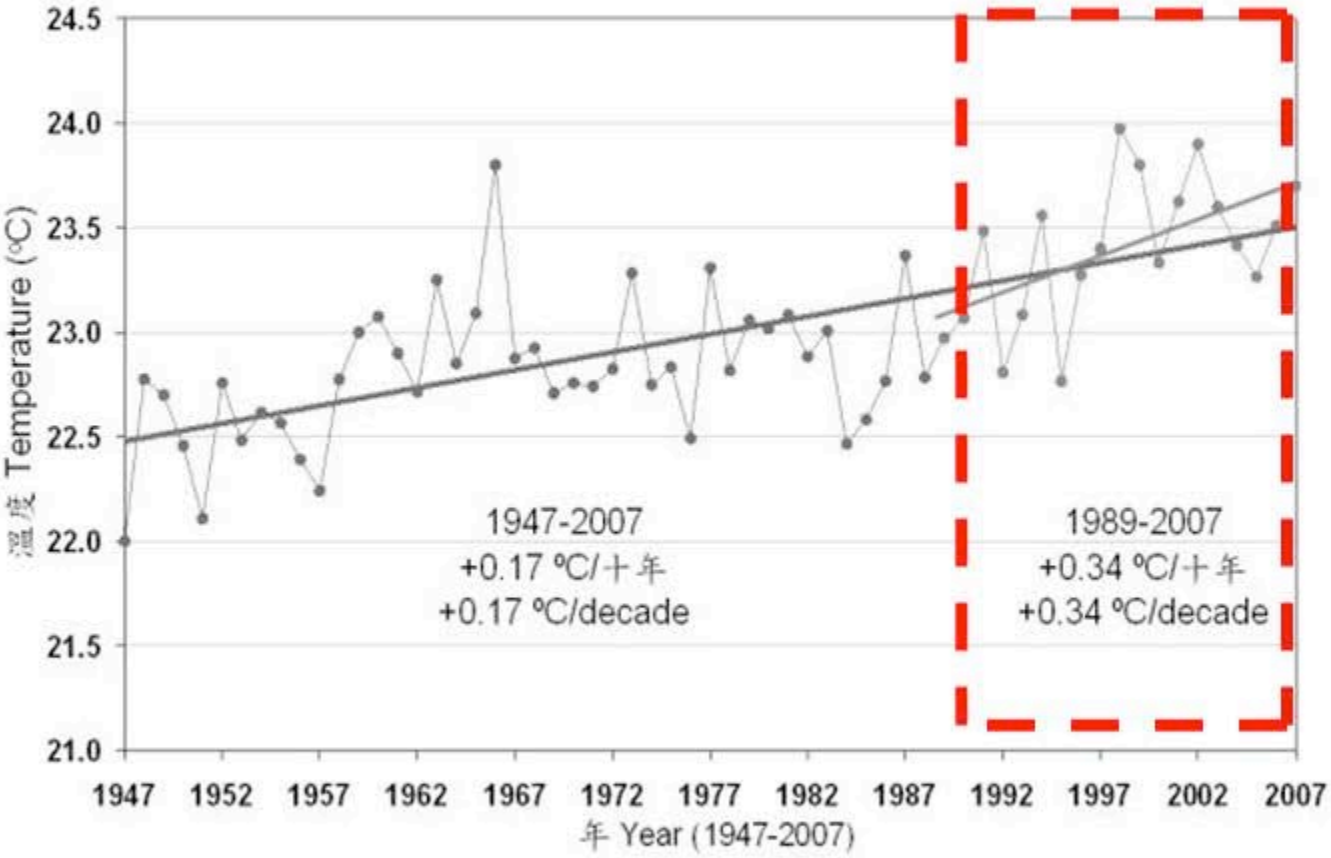
2nd International Conference on Countermeasures to Urban Heat Islands, 21-23 Sept 2009 – Berkeley, California, USA

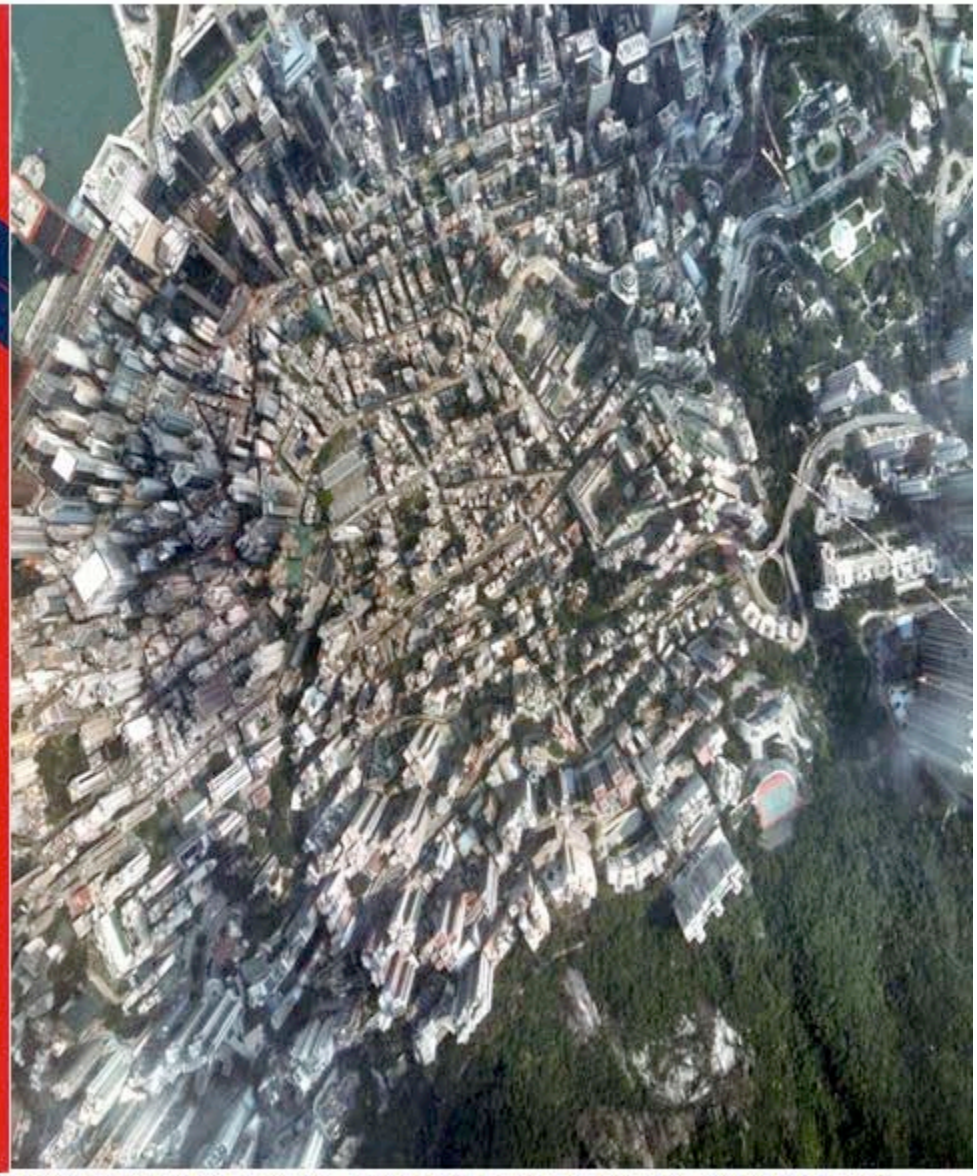
Hong Kong – The land & its people



The city is warming up faster



The urban environment



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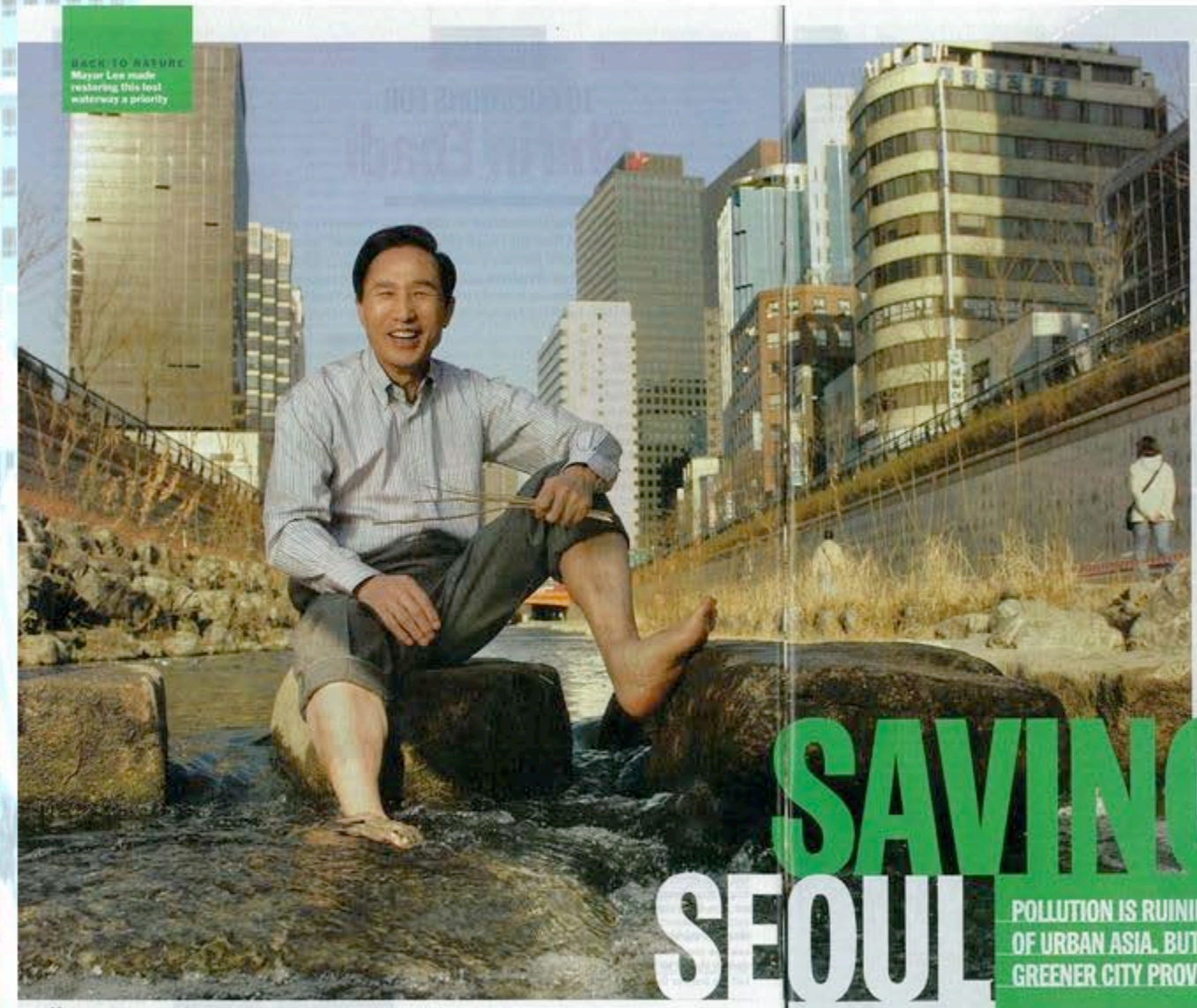
Cities of extreme density and intensity

UHI, is there is real solution?



BACK TO NATURE
Mayor Lee made restoring this lost waterway a priority

ASIA

SAVING SEOUL

POLLUTION IS RUINING THE QUALITY OF LIFE IN MUCH OF URBAN ASIA. BUT SEOUL'S TRANSFORMATION INTO A GREENER CITY PROVES THE TIDE CAN STILL BE TURNED

■ BY BRYAN WALSH

STANDING ANKLE-DEEP IN THE FRIGID WATERS OF Seoul's reborn Cheonggyecheon stream, a blustery March wind whipping through his suit, Mayor Lee Myung Bak could be forgiven for reconsidering this whole environmentalism thing. As a young employee at Hyundai Construction and Engineering in the 1960s, Lee helped pave over the once polluted stream, burying it under an elevated highway that would carry about 168,000 cars a day into the heart of the city. It was the kind of massive modern development that Lee later repeated throughout South Korea during his concrete-pouring tenure as CEO of Hyundai Construction and other Hyundai affiliates in the 1970s and '80s—a period when he earned the nickname "the Bulldozer." Lee kept on bulldozing when he became mayor of Seoul in 2002, but this time with a very different purpose. He started with Cheonggyecheon, ripping down the highway, tearing off the paving, pumping in water and landscaping the banks to create a 5.8-km-long, $360 million piece of urban watershed—in which he's currently standing, stoically enduring the early-morning chill. "The stream is cold, but that means it's clean," says Lee. "When it's warmer, young boys and girls will play in this water. I'm very happy with it."

Seoul—a city long synonymous with unchecked urban development, where Parks were more commonly found in the phone book than on the streets—is growing green. Besides the restored Cheonggyecheon, which opened last October, the city has helped plant some 3.3 million trees since 1998 and recently developed Seoul Forest, a $224 million patch of urban woodland comparable to London's Hyde Park. A cutting-edge, clean-running transit system is slowly weaning Seoulites off their auto addiction. New museums including the Leeum, which houses Samsung's corporate art collection in a stylish building designed by

16 TIME, MAY 15, 2006

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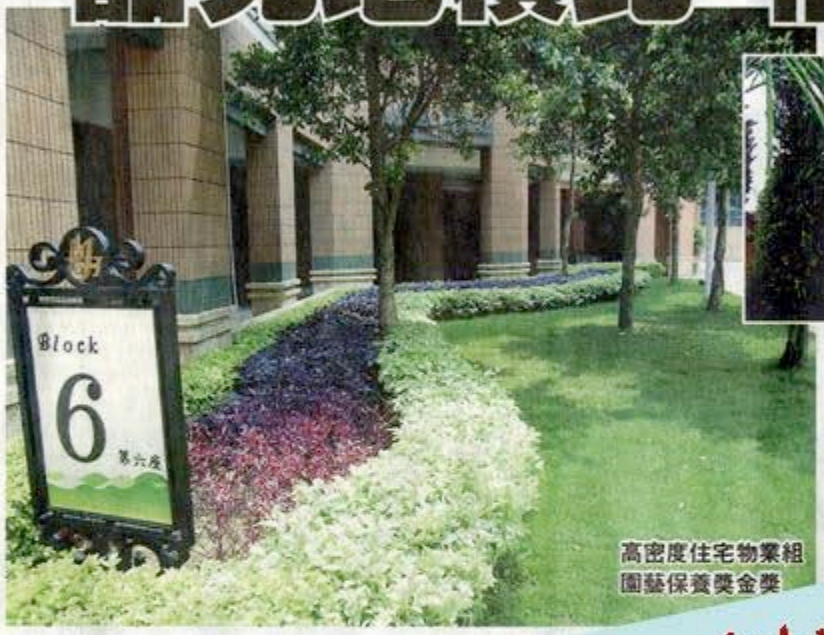
The quest for greenery

豁免地積比 倡綠化樓宇



↑位於荔枝角、樓齡逾20年的天麗大廈奪得非住宅物業園景設計優異獎，該大廈本身是工廠大廈，去年底落成的天台花園佔地3000平方呎，除了綠化，亦提供康樂設施如燒烤爐，填補工廠區內的綠洲。（康文署網頁圖片）

青衣曉峰園奪得高密度住宅物業組園藝保養獎金獎，啟勝物業管理有限公司物業及設施經理葉國偉表示，佔地2萬平方呎的草地之下其實是停車場，每逢假日會開放供居民活動。平日開放時，3名園藝工人會為草地施肥、澆水、修剪、清除雜草及治蟲，令草地四季維持綠[illegible]地連同屋苑內綠化地帶，佔屋苑整體平[illegible]屋苑的4成為高。

（啟勝物業管理有限公司提供）

←獲高密度住宅物業組園藝保養獎金獎的青衣曉峰園的[illegible]

深灣軒奪得高密度住宅物業組園景設計金獎，負責為該屋苑綠化的貝爾高林環境景觀規劃師設計組總監譚子彤表示，深灣軒地面空間不多，設計綠化時，將屋苑與周圍自然環境融合，外圍多種植本地品種植物如榕樹，營造大自然感覺，屋苑內康樂設施如泳池及樓宇出入口則種植色彩較豐富的植物，令屋苑有大量綠化空間。（郭慶輝攝）

Greenery encouraged with plot ratio exemption!

【明報專訊】政府正研究以豁免地積比率鼓勵發[illegible]在興建新樓宇時，騰出更多綠化空[illegible]行人路邊創[illegible]

[illegible]訂時間表

丘腦製咋出席「2006啟佳園林大獎——私人物業」頒獎禮後表示，近年私人物業綠化質素提高，今年參加比賽的物業數目，較04年首次舉辦時大幅增加88%至239個。該署發現，不少物業由過去的「地面」綠化，演變成近兩年的「垂直」綠化，除了地面，其他平面如平台、天台等，亦成為綠化地點，令總綠化面積大幅增加。

康文署已經向綠化總調委員會建議，透過向發展商提供豁免地積比率，鼓勵發展商為物業提供更多綠化空間。

統籌該委員會的環境運輸及工務局表示，豁免地積比屬長遠措施，涉及多個政策局，仍在研究階段，暫未有推行時間表。

[illegible]出面積後才發現植[illegible]生長成樹木枯萎，怎麼辦？」他認為，政府可透過優質樓宇標籤來獎勵綠化樓宇，發展商亦可因此間接得益。

倡加入條件確保成效

香港測量師學會工料測量組主席何學強分析，過去發展商較著重回報，平台騰出的空間多會興建泳池、球場及會所等休憩設施，餘下的綠化空間有限，以豁免地積比作誘因，相信可增綠化面積，綠色力量行政總幹事文志森表示，本產其中一個污染源來自路邊汽車，樓宇向後移騰出空間植樹，有助改善空氣污[illegible]形同虛設。

曉峰園得園藝保養金獎

康文署今頒發11項金獎及22項優異獎，當中奪得高密度住宅物業組園藝保養金獎的青衣曉峰園，其物業管理公司在該屋苑的停車場上面綠化成一幅「草原」，逢假日開放給居民休憩。非住宅組別除了一些甲級商業樓宇，如其江公園、中環中心奪得獎項，樓齡逾20年的荔枝角天麗大廈亦奪得設計優異獎，天麗大廈是工廠大廈，去年底落成的天台花園約3000平方呎，提供康樂設施如燒烤爐，管理公司形容「達到綠化環境及經濟回報上的雙重效益」。

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The quest for ventilation

港104屏風樓影響150萬人

■位於東涌海旁的映灣園等樓宇，一字排開，是全港最長的屏風陣。

荃灣 ⑧
西九龍 ①②⑤
東涌 ⑨⑩
美孚 ③
九龍城 ⑥
將軍澳 ⑦
西灣河 ④
新界
九龍
大嶼山
香港

最多屏風屋苑區域

區域	屏風屋苑數目
將軍澳	12
大角嘴/旺角	11
馬鞍山	7
	6

註：大角嘴，荔枝角及九龍站的屏風屋苑均在西九龍新發展區內
資料來源：環保觸覺

十大屏風屋苑區域分布

屋苑名稱（區域）			
① [illegible]		[illegible]煤氣	
② 西		[illegible]藍灣畔	信和/嘉里/地鐵
③ 美	[illegible]/地鐵	⑧ 荃灣萬景峰	信和/市建局
④ 西[illegible]灣	恒基/中華煤氣	⑨ 東涌映灣園	長江/和記黃埔/地鐵
⑤ 西九龍君臨天下	恒隆	⑩ 東涌藍天海岸	香港美業

【本報訊】本港地少人多，樓宇愈建愈高，環保組織「環保觸覺」進行的調查發現，過去十年間落成的138個私人屋苑中，超過75%屋苑符合屏風樓宇的指標，當中以將軍澳、大角嘴及旺角等區屏風屋苑數目最多，令人憂慮的是，政府未有考慮遏止屏風樓宇增長，輕忽的山脊線及廣闊的海景等天然資源在漸次蕩然無存的危機下，本港遲早掛上「亞洲屏風都會」的污名。

將軍澳屏風樓最多

環保觸覺在月前成功搶[illegible]成的[illegible]

[illegible]樓宇的存在有礙市區空氣[illegible]通，對空氣質素有着關鍵影響，該組織估計受到屏風樓宇影響的人口達到150萬人。

調查發現，單以區域計算，向來被人詬病樓宇密度過高的將軍澳，成為全港擁有最多、共12個屏風屋苑的區域，大角嘴及旺角也有11個屏風屋苑，僅次於將軍澳高踞第二位。

調查又根據私人屋苑帶來的影響，評選出全港十大屏風屋苑，其中位處深水埗的港灣豪庭、大角嘴的君匯港及美孚的曼克頓山，依次被評為首三位的屏風屋苑，其他入圍十大的屋苑，分別存在影響整個區域環境、建築物過於龐大，以及與周邊環境不協調等問題。

映灣園屏風陣最長

環保觸覺主席譚凱邦不諱言，港灣豪[illegible]被評為屏風樓宇的原因[illegible]

[illegible]全港最長[illegible]整個屏風陣中包含24座不同私人屋苑的樓宇。

已落成樓宇造成的屏風效應已無從挽救，譚凱邦坦言令人憂慮的是已有九項鐵路上蓋的地產項目已在規劃興建階段，這些分布於西鐵南昌站、烏溪沙、大圍及元朗等地方的項目合計有75座屏風樓宇，動輒樓高達到50層，對景觀的破壞難以想像，他建議政府調低補地價金額，以游說鐵路項目的地產發展商降低樓宇地積比率，及時挽救本港，免成亞洲屏風都會。

6指[illegible]屏風樓

話你知

環保觸覺指出，評估屏風樓宇有一套客觀指標，首先是考慮樓宇是否建於海旁、市中心及通心廊等具影響[illegible]，以[illegible]相對[illegible]的[illegible]評估指標，如考慮屋苑樓宇與樓宇間的距離是否少於15米，以及屋苑連同平台的高度是否超越35層；屋苑樓宇布局是否接近「一字型」排開，較廣闊的一面迎向由海洋吹向內陸的盛行風。在6個指標中，符合3個或以上指標的屋苑均會被定性為屏風樓宇。

Wall and screen like buildings affecting 1.5 million in the city!

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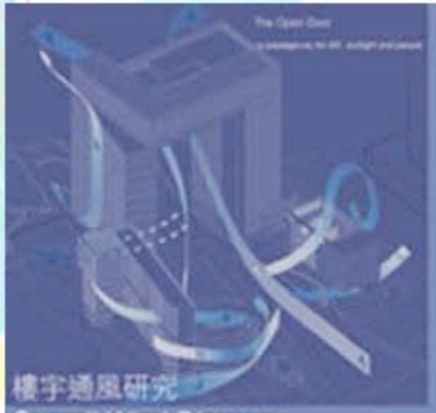
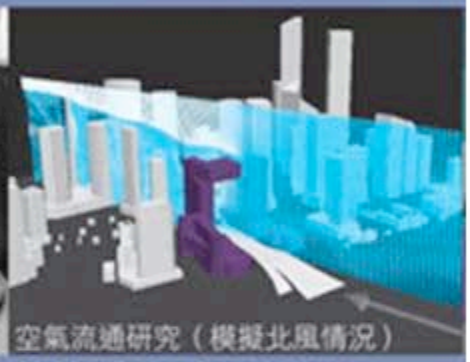
Urban ventilation and urban permeability

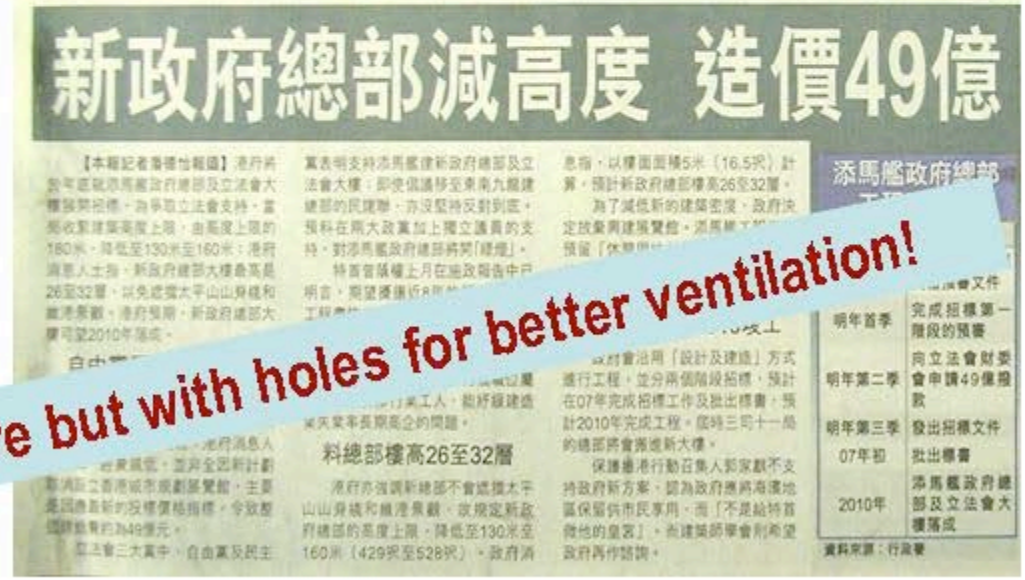


Overall Wind Diagram


Wind Tunnel Test



Air Ventilation Assessment
(Prevailing North Wind)


新政府總部減高度 造價49億

料總部樓高26至32層

添馬艦政府總部

明年首季	完成招標第一階段的預審
明年第二季	向立法會財委會申請49億撥款
明年第三季	發出招標文件
07年初	批出標書
2010年	添馬艦政府總部及立法會大樓落成

資料來源：行政署

Green government HQ costs more but with holes for better ventilation!

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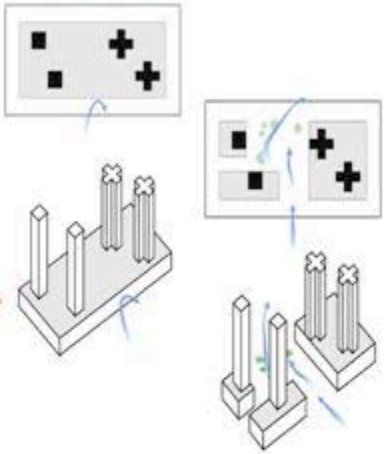
Urban ventilation and urban permeability

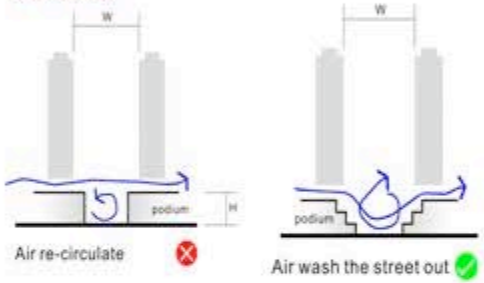
Guidelines on Air Ventilation Assessment



Qualitative guidelines IV

Non-building Area

Compact developments on large sites are particularly impeding air movement. Development plots should be laid out and orientated to maximize air penetration by aligning the longer frontage in parallel to the wind direction and by introducing non-building areas and setbacks where appropriate.

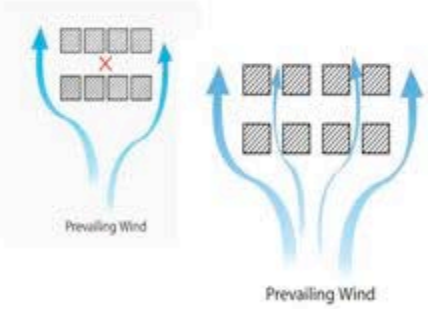


Qualitative guidelines VI

Scale of Podium

For large development sites particularly in the existing urban areas, increase permeability of the podium structure at the street levels by providing some ventilation corridors or setback in parallel to the prevailing wind.

Where appropriate, a terraced podium design should be adopted to direct downward airflow, which can help enhance air movement at the pedestrian level.



Qualitative guidelines VIII

Building Disposition

Where practicable, adequately wide gaps should be provided between building blocks to maximize the air permeability of the development and minimize its impact on wind capturing potential of adjacent developments. The gaps for enhancing air permeability are preferably at a face perpendicular to the prevailing wind.

Department of Architecture, The Chinese University of Hong Kong on behalf of
Planning Department Hong Kong SAR
Feasibility Study for Establishment of Air Ventilation Assessment System

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Consultancy Study on
Building Design that Supports Urban Living Space in HK

Objectives	Strategies	Planning Actions
UHI Thermal Comfort	Albedo	• Cool material-building & pavement; • Cool roof & facade; • Water retention paving;
	Vegetation	• Planting & greeneries; • Parks & open spaces;
+	Shading	• Building geometric design; • Shelter design; • Street orientation; • H/W ratio; • Trees;
Urban Ventilation Dynamics	Ventilation	• Air paths; • Building ground cover & building bulks; • H/W ratio; • Street orientation; • Open spaces; • Building disposition;

Planning Time Scale

Short time

Material & Surface Level Intervention

Building Level Intervention

Urban & Planning Level Intervention

Long time

Spatial Scale

Macro Effect

Micro Effect

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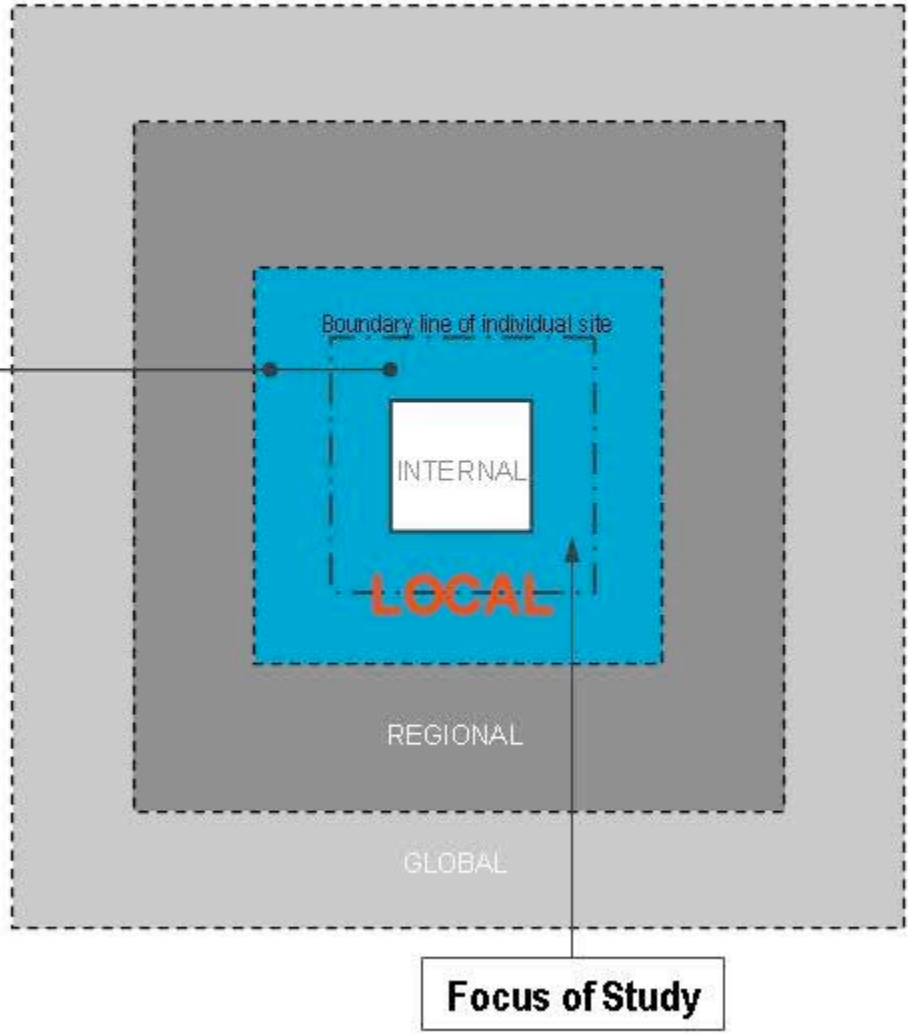
Consultancy Study on
Building Design that Supports Urban Living Space in HK

Generic Urban Living Space Issues in Hong Kong:

Air Ventilation, Heat Island Effect, etc | **Pedestrian Environment** | **Greenery** | ...

The Study is to review **building regulations and practices** and recommend any areas for improvement with a view to promoting **new building design** of individual development sites that can improve our **urban living space**.



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Review of Existing Measures

Extracted from Kowloon Planning Area No. 14(Part) Kwun Tong (Western Part) **Outline Development Plan** D/K14A/1E

← MAJOR SCOPE OF WORKS →

Planning Level Examples of Relevant Guidelines & Measures	Urban Living Quality Key Design Problems	Building Level Examples of Relevant Regulations & Practice Notes
Urban Design Guidelines Public Realm e.g., maximize planting in open space; reserve more ground level spaces and setbacks for tree planting and street activities; provide more green areas and amenity strips along circulation routes) **Outline Development Plan & Layout Plan** Streetscape Stipulation of setback along site boundary for non-building area **AVA Guidelines:** Shading and greenery, etc.	**Lack of urban greenery**	**Building (Planning) Regulation** 20 & **PNAPs** 233 & 280: Site Coverage, Open Space Provision, and Dedication of Land/Area for Use as Public Passage. **PNAPs** 116 & 258 & **JPNs** 1 & 2: Amenity Features (podium roof gardens, etc.), Provision of Sky Garden in Refuge Floor, Communal Sky Gardens, and Balconies.

Consultancy Study on
Building Design that Supports Urban Living Space in HK

Review of Existing Measures

← MAJOR SCOPE OF WORKS →

Planning Level Examples of Relevant Guidelines & Measures	Urban Living Quality Key Design Problems	Building Level Examples of Relevant Regulations & Practice Notes
Urban Design Guidelines Development Height Profile e.g., lowering of building height where appropriate to provide breezeways, etc. Waterfront Sites e.g., providing breezeways to the waterfront Breezeways e.g., position open areas, podium, low-rise development and non-building areas to funnel natural air flow, etc. Streetscape e.g., provide solar shade for pedestrian, etc. **Statutory Plan (Outline Zoning Plan & Development Permission Area Plan)** Land use zonings and stipulation of building height control **AVA Guidelines** Breezeway and air path, linkage of open spaces, non-building area, waterfront sites, scale of podium, building heights, building disposition, horizontal projections, etc.)	**Barrier to design for natural ventilation/ lighting**	**Building (Planning) Regulation** 20 & **PNAPs** 233 & 280: Site Coverage, Open Space Provision, & Dedication of Land/Area for Use as Public Passage. **Building (Planning) Regulation** 20(3) & **PNAP** 223: Podium Height Restriction under B(P)R 20(3). **Building (Planning) Regulation** 22 & **PNAPs** 49 & 70: Building Proposal affected by Street Widening, & Street Improvement Schemes. **PNAPs** 116 & 258 and **JPNs** 1 & 2: Amenity Features (podium roof gardens, etc.), and Communal Sky Gardens.

Consultancy Study on
Building Design that Supports Urban Living Space in HK

Review of Existing Measures

← MAJOR SCOPE OF WORKS →

Planning Level Examples of Relevant Guidelines & Measures	Urban Living Quality Key Design Problems	Building Level Examples of Relevant Regulations & Practice Notes
Urban Design Guidelines Public Realm e.g., introduce setback at appropriate corner site, adopt high quality architectural design building facade and podium edge at ground and first floor levels, encourage provision of open space at ground, podium and roof levels, etc. Streetscape e.g., provide shade for pedestrian, reduce podium coverage to allow more open spaces at grade, etc. **AVA Guidelines** Shading & greenery, cool materials, etc.	Undesirable pedestrian environment	**Building (Planning) Regulation** 20 & **PNAPs** 233 & 280: Site Coverage, Open Space Provision, & Dedication of Land/Area for Use as Public Passage. **Building (Planning) Regulation** 20(3) & **PNAP** 223: Podium Height Restriction under B(P)R 20(3). **Building (Planning) Regulation** 22 & **PNAPs** 49 & 70: Building Proposal affected by Street Widening, & Street Improvement Schemes.

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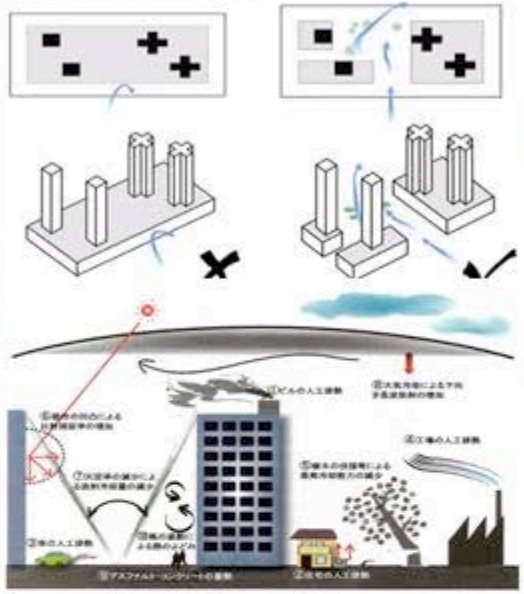
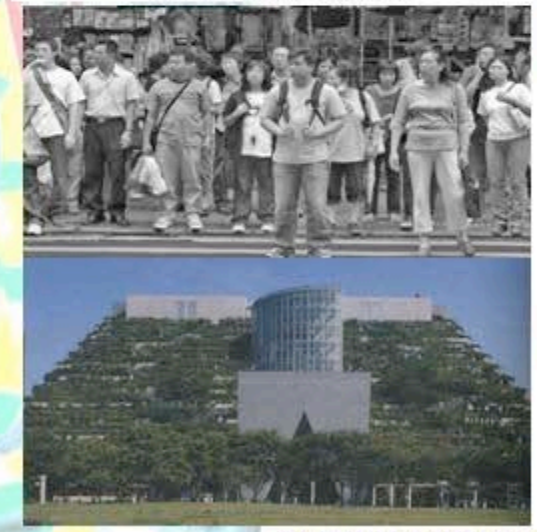
Building Design that Supports Urban Living Space in HK





Identification of Priority Areas

Promoting building design that facilitates better **air ventilation**

Promoting building design that mitigates the **heat island effect**

Promoting building design that enhances the **pedestrian environment / public space**

Promoting building design that provides more **greenery**

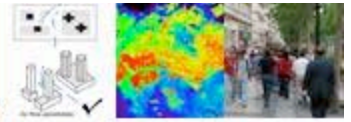
2nd International Conference on Countermeasures to Urban Heat Islands, 21-23 Sept 2009 – Berkeley, California, USA

Identification of Deficiencies & Constraints

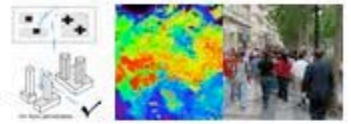
- Need for an Overall Framework

Sustainable City Programme Goals
Building Sector Objectives
Indicators
Building Design Guidelines
Recommended Practice

- Need for Effective Measures
- Need for Performance-based Approach



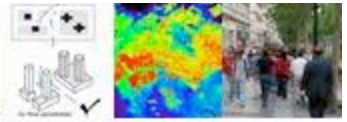
1. Building Separation / Permeability



2. Site Coverage of Greenery

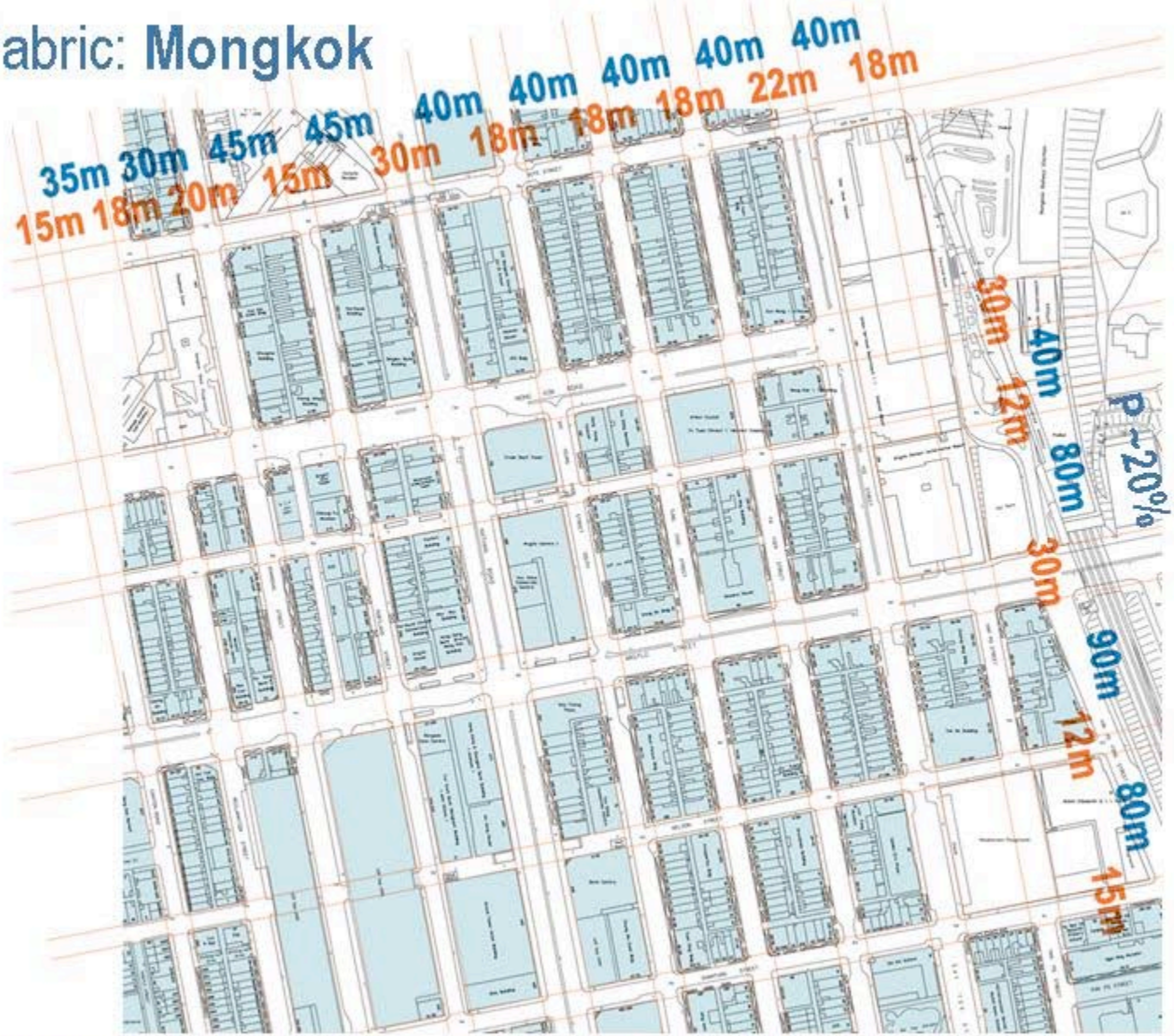
3. Setback for Minimum Air Volume at Pedestrian Zone in Deep & Narrow Street Canyon

1. Building Separation / Permeability

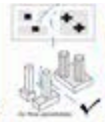


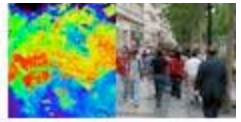
Existing Urban Fabric: **Mongkok**

P ~30%
(Lp = 30~45m,
S = 15~30m)



1. Building Separation / Permeability

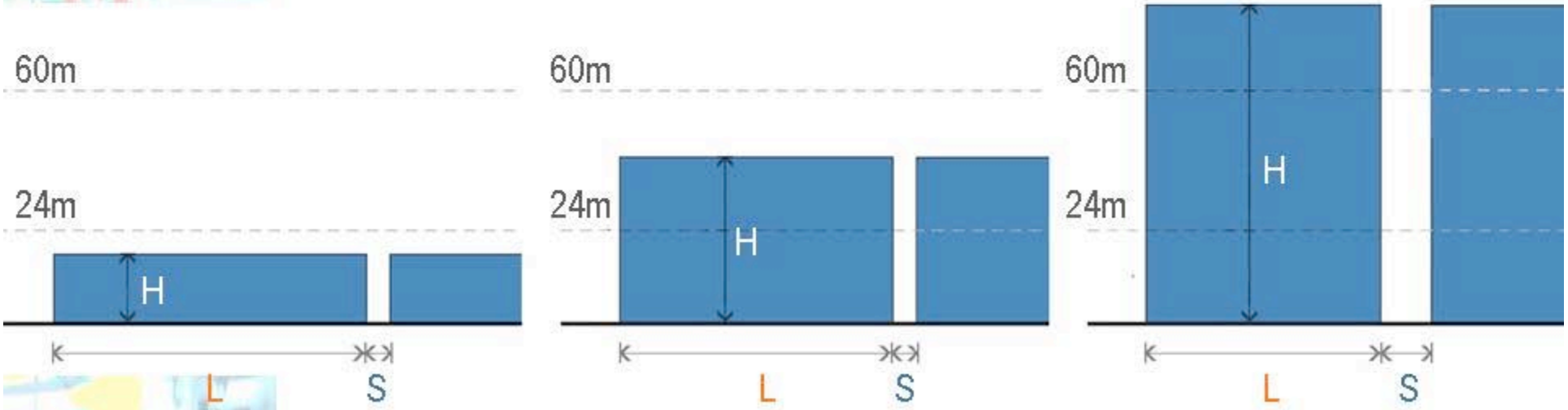




Reference Standard: Mainland China

Building Height (H)	Continuous Length of Building Facade (L) (As projected to the adjoining street alignment)	Building Separation (S)
H ≤ 24m	Max. **80**m	Min. **6**m (or usually 9m for fire separation)
24m < H ≤ 60m	Max. **70**m	Min. **6**m;**13**m for H>30m
H > 60m	Max. **60**m	Min. **13** / **18**m (Min. **22** / **26**m in less dense zoning areas)

Building separation required by different building heights in Mainland China



1. Building Separation / Permeability

Reference Standard: Mainland China

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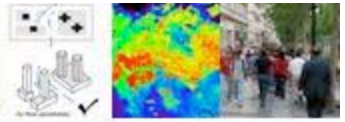
1. Building Separation / Permeability



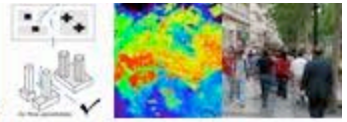
Recommendation:

Min. permeability for massive buildings

(dependent on its building height and site area)

Building Height (H)	Building Permeability (P)	
	For site < 2 ha and with any continuous projected facade length (Lp) ≥ 60m	For site≥ 2 ha
≤ 60m	1/5 (20%)	1/4 (25%)
> 60m	1/5 (20%)	1/3 (33.3%)

1. Building Separation / Permeability



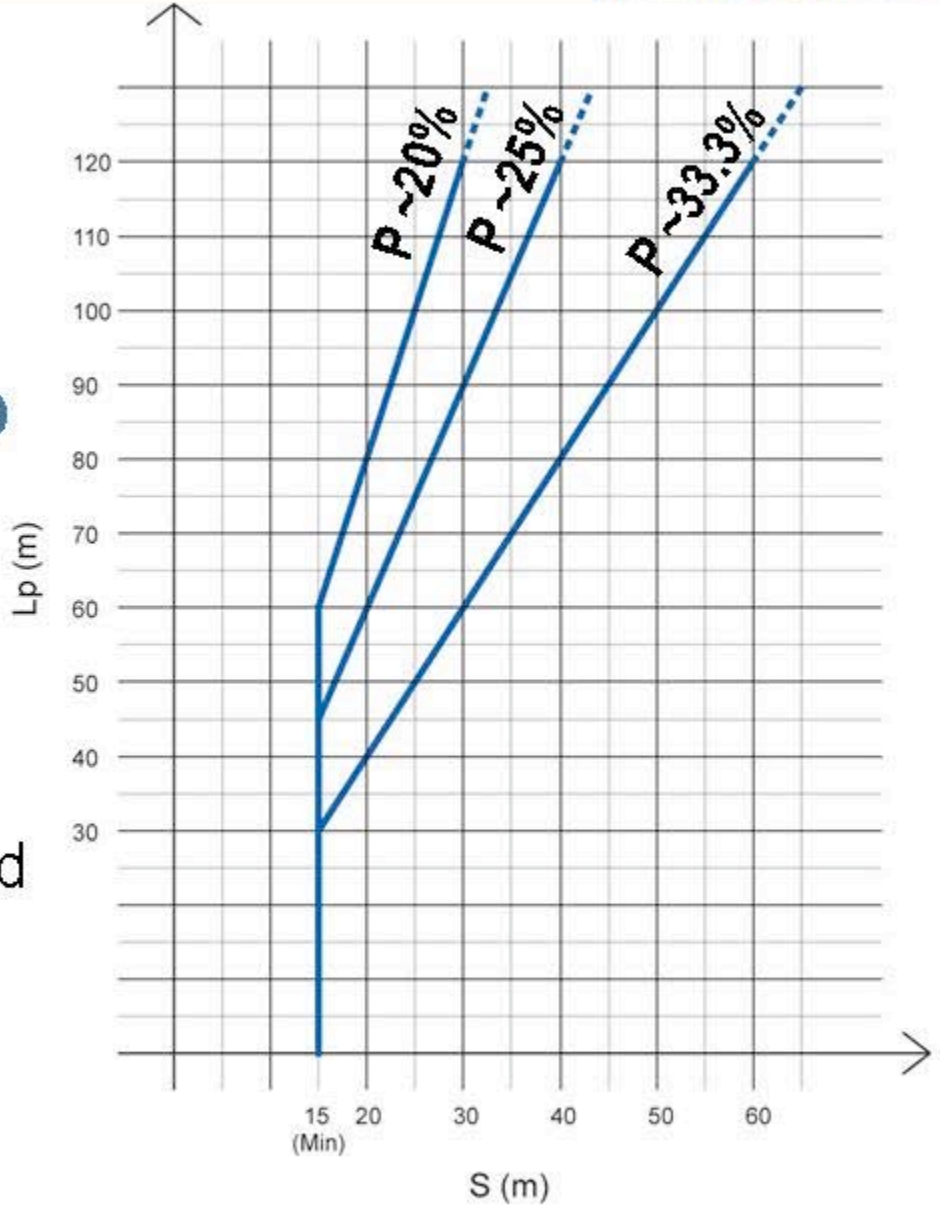
Design Principle 1:

Building Separation (S)

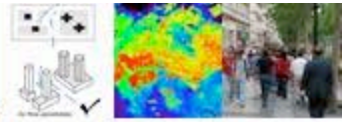
Provision of S

- **directly proportional to Lp**
- **≥15m**

For the immediate context taken into account, the **1/2S** criteria can be applied to the facade ends with separation distance measured from the adjoining boundary line or the centerline of adjoining street.



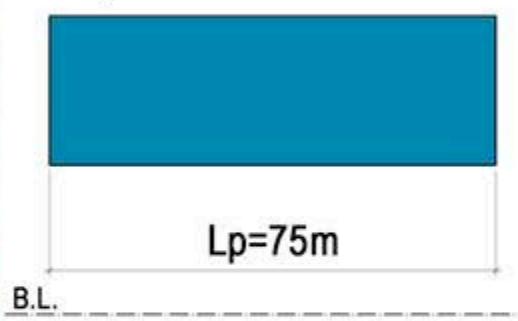
1. Building Separation / Permeability

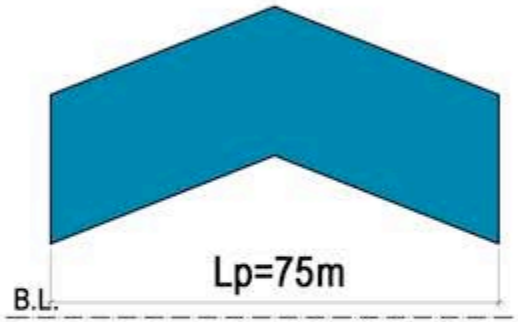


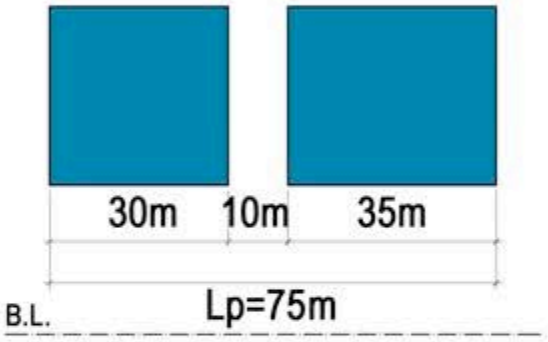
"Continuous projected facade length (Lp)":

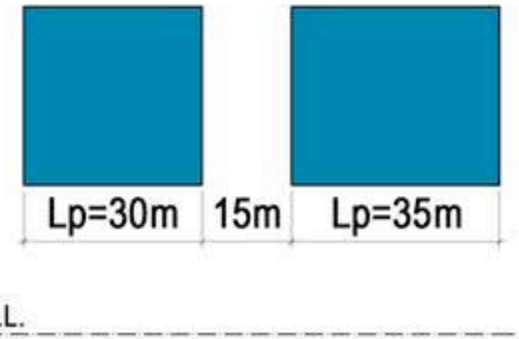
The total projected length of facade of a building or buildings if any separation in-between < 15m.

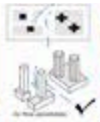
Examples:

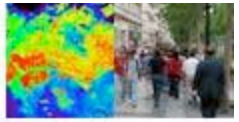








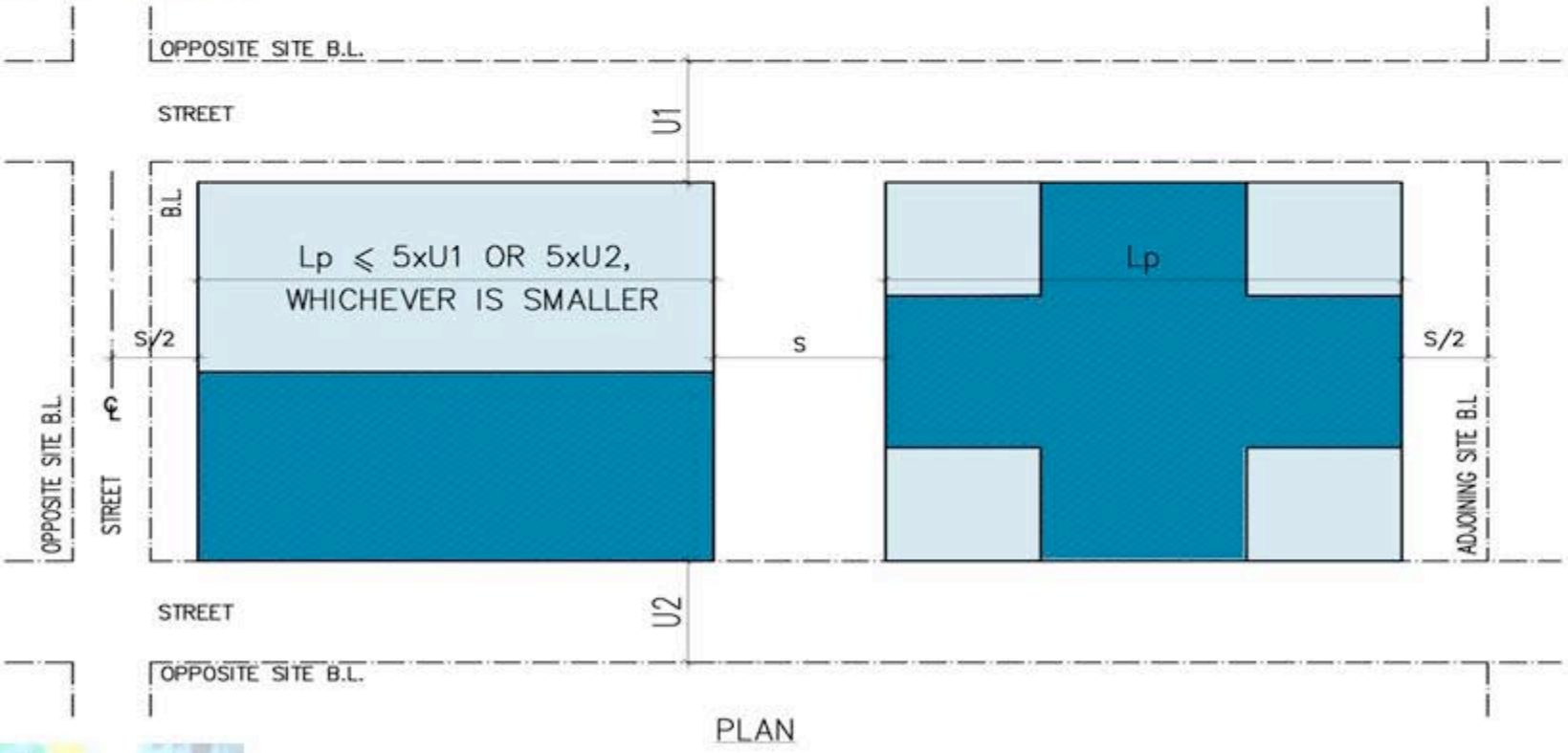


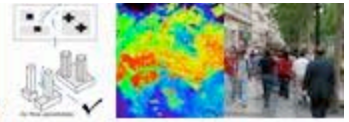


Design Principle 2:

Maximum Permissible Length of Lp

- **Lp** shall not be larger than **5 times** of the mean width of the adjoining urban canyons.

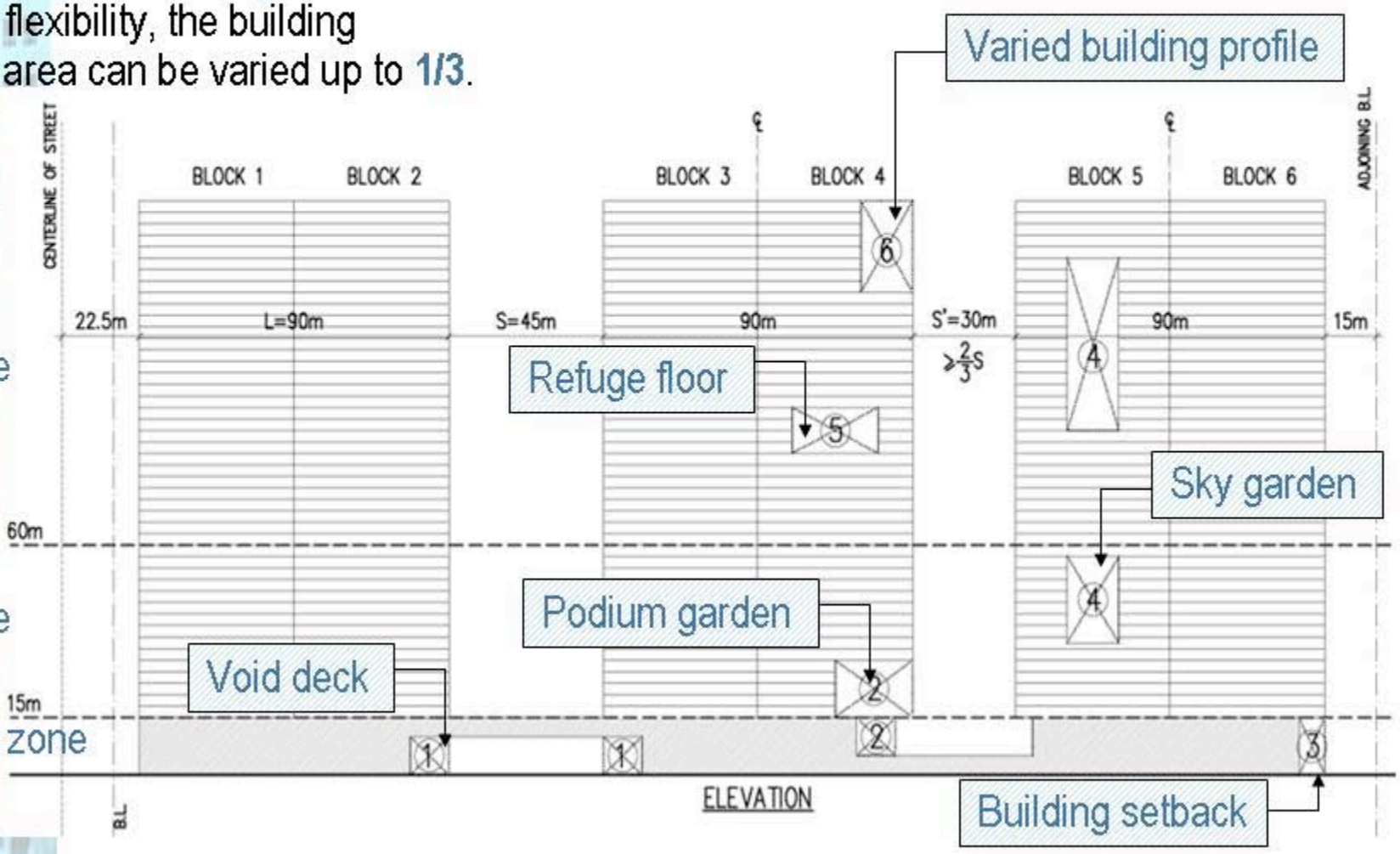


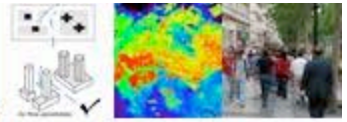


Design Principle 3:

Building Design Alternative

For design flexibility, the building separation area can be varied up to **1/3**.

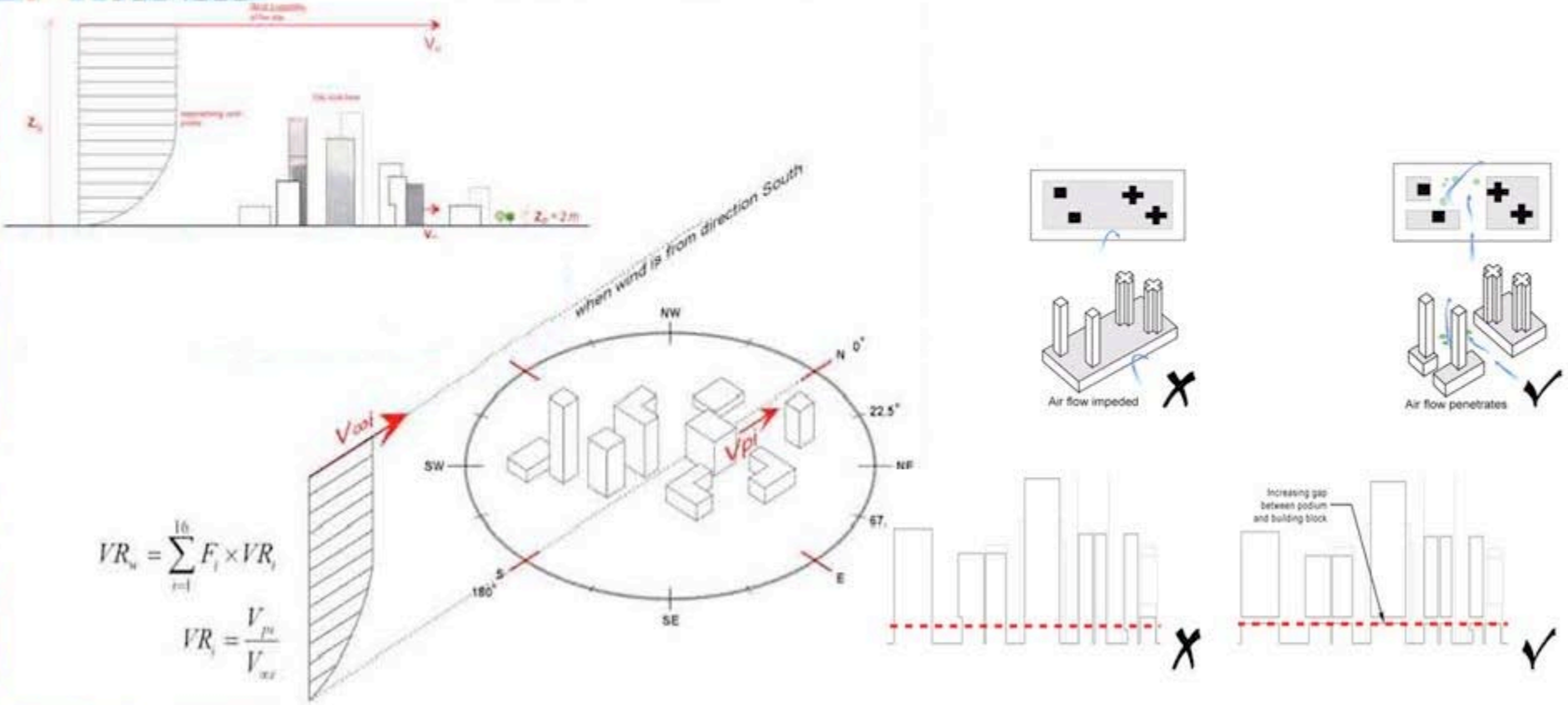




Design Principle 4:

Performance-based Design Alternative

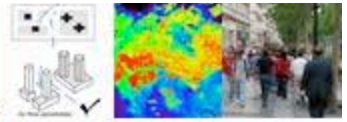
- Performance-based method for AVA system of PlanD.



$$VR_w = \sum_{i=1}^{16} F_i \times VR_i$$

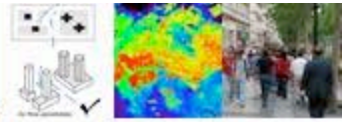
$$VR_i = \frac{V_{pi}}{V_{ref}}$$

1. Building Separation / Permeability



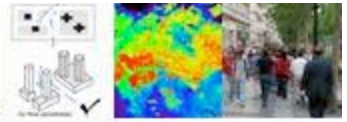
Example of Built Project with P ~ 20% at tower portion:
Residential Development in Tai Koo Shing

1. Building Separation / Permeability



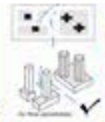
Example of Built Project with P ~ 25% at tower portion :
Residential Development in West Kowloon

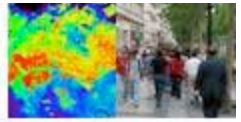
1. Building Separation / Permeability



Example of Built Project with P ~ 33.3% at tower portion :
Residential Development in Shatin

1. Building Separation / Permeability





South China Morning Post

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Monday, November 17, 2008 南華早報

Set limits would give buildings breathing room

Plan for more space to curb 'wall effect'

Olga Wong

New rules requiring wider gaps between buildings will be proposed to reduce the so-called wall effect caused by high-rises blocking air flow, a source close to the government said.

The rules, to be proposed in a forthcoming public consultation, would require 30 per cent of a site's length to be set aside for space between buildings, and 30 per cent of the land area being allocated to landscaping and "green" features.

There is currently no standard requirement on gaps between buildings, which is usually determined on a case by case basis using air ventilation studies and considering the size of the development. There is also no standard requirement for green features.

The source said care would be taken to prevent developers from profiting from the proposed green space by increasing the overall development density.

The move follows controversy over present arrangements that award bonus floor area in return for incorporating features such as sky gardens, utility platforms and bigger lobbies and corridors that are assumed to improve the quality of life in the developments.

Secretary for Development Carrie Lam Cheng Yuet-ngor said last month the government would consult the public this year on how green features should be incorporated into new developments without increasing the density of the project.

The consultation is expected to start as early as next month.

The source said building permeability and the green ratio – which refers to the minimum space between blocks and the amount of green space respectively – were major issues under consideration.

Based on air ventilation studies and overseas examples, a government consultant had advised that leaving 30 per cent of a site's length as gaps would ensure air flow and prevent "walled buildings".

"Walled buildings are formed when developers put buildings along the same line to maximise sea views," the source said. "To prevent walled buildings, developers would be required to leave at least 30 metres as non-building area if a site is 100 metres long."

Editorial A14

A standard requirement would be easier to implement than working out a figure for each site, the source said. "As a start, developers could be asked to meet a minimum requirement since studying the wind environment of every single site would require much more effort."

The source said a minimum of 30 per cent green area had been a requirement for developments on the mainland for many years.

"A site should have 30 per cent green area when we look at its aerial photo," the source said. He acknowledged that the requirement could add management and development costs to government departments and developers in exchange for a better environment.

Patrick Lau Sau-shing, the legislator representing the architectural, surveying and planning sector, said increasing the permeability of developments would eliminate podium structures but encourage taller buildings, which might violate the government's new height restrictions.

He said imposing a site-specific amount of non-building area was preferable, and reducing the allowed development density would be the most effective way to minimise the wall effect.

Andrew Thomson, chief executive of the Business Environment Council, an independent non-profit group that promotes corporate social and environmental responsibility, welcomed the initiative but stressed that the business sector would prefer a more flexible approach as the wind factor varied at different locations. "We would welcome a guiding principle. Prescriptive requirements could result in boring designs."

A Development Bureau spokeswoman said the consultation would be held as soon as possible.

2nd International Conference on Countermeasures to Urban Heat Islands, 21-23 Sept 2009 – Berkeley, California, USA

Recommendations of Study

1. Building Separation / Permeability

2. **Site Coverage of Greenery**

3. Setback for Minimum Air Volume at Pedestrian Zone in Deep & Narrow Street Canyon

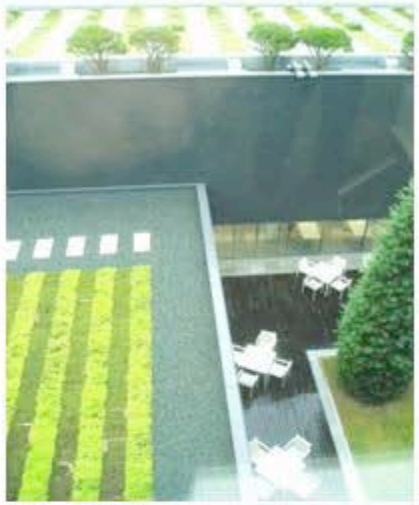
2. Site Coverage of Greenery

Reference Standards

1. BEAM, HK

Site Coverage of Greenery > 30%

2.2.4	LANDSCAPING AND PLANTERS	1 credit for using pervious materials for a minimum of 50% of hard landscaped areas.
		1 credit for providing appropriate planting on site equivalent to at least 30% of the site area.



2. China

Site Coverage of Greenery > 30%

(Chinese cities such as Beijing, Shanghai and Guangzhou where their respective urban area has achieved a coverage of about 40% green coverage on average, while their individual development sites are required to provide at least 30% coverage of greenery on a mandatory basis)

3. Tokyo

Green Roof > 20%

(Since April 2001, the TMG required new buildings on site larger than 1, 000m2 [or 250m2 for public buildings], have at least 20% of the rooftop as greenery.)

2. Site Coverage of Greenery

Recommendation in the Final Report:

Site coverage of greenery for new development to enhance urban greenery: $\geq 30\%$

Notes:

1. For development with site area < 1,000m2, recommended SC of Greenery can be waived.
2. For development with site area between 1,000m2 and 2ha, recommended SC of Greenery can be reduced to **20%**.
3. Grass paver: accountable subject to the actual surface area of greenery of individual paving system.
4. Vertical greenery: accountable with a reduction factor of 0.5.
5. Other features (e.g. water body) that may improve the micro-climate in a similar way can be suggested for consideration as equivalence with or without a reduction factor.
   (Item no.4 & 5 may be capped by a max. allowable %)
6. Exemption can be considered on individual merits of special case, e.g. prison.

2. Site Coverage of Greenery

Overseas Examples:

High-density residential development in Osaka, Japan, with S-rating in CASBEE-HI assessment:

Site area – **0.15 ha**

Plot ratio – 3

Site coverage of greenery – **20%**

(Source: CASBEE-HI Tool-4 2006 by Institute of Building Environment and Energy Conservation, Japan)

評価分野	中項目	計画上の配慮事項
風通し	Q_H-1	風が建物を通り抜けるように共用廊下を配置し、夏でも涼しい環境を作り出している。
	LR_H-1	三方が道路に面まれており、隣の建物と敷地境界を接する面は1階に駐車場を配置し、風の流れを妨げない。
日陰	Q_H-2	共用廊下が南面にあり、住戸に対して庇を形成し、日陰部分を多く確保している。
	LR_H-2	南側中央と建物外周に緑地を配置し、周辺にも日陰を形成する。
緑地・水面の確保	Q_H-3	ベランダやテラスにも緑地を配置し、建物全体で1,012m2の植栽をしている。
	LR_H-3	地表面は緑地部分を可能な限り確保し、地表面温度の上昇を抑える。
緑化	Q_H-4	ベランダやテラスにも緑地を配置し、建物全体で1,012m2の植栽をしている。
	LR_H-4	ALC などの建材にステンレスパネルを外装し、空気の通り道を確保することで、日射蓄熱を防止、熱線反射ペアガラスを上階である5～6階に採用し、屋上には太陽光発電パネル(単結晶シリコン型、7.5kW)を設置している。
排熱位置等	Q_H-5	冷却塔を屋上に集中設置し、高い位置で排熱を放出する。
	LR_H-5	コージェネレーション、高断熱建築等で一次エネルギーを削減し、建物からの放熱を抑える。

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2. Site Coverage of Greenery

Overseas Examples:

High-density mixed-use development in Tokyo, Japan, with A-rating in CASBEE-HI assessment:

Site area – **1.36 ha**

Plot ratio – 6

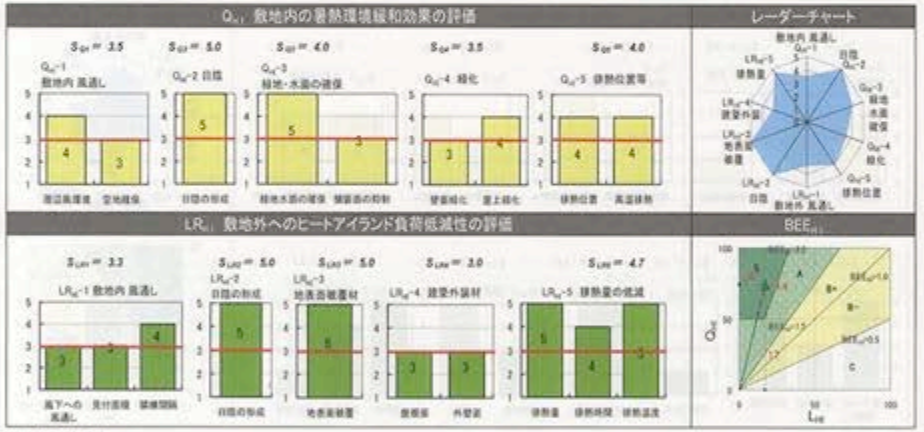
Site coverage of greenery – **24.3%**

(Source: CASBEE-HI Tool-4 2006 by Institute of Building Environment and Energy Conservation, Japan)

ケース 14（立地条件②、複合用途）　　評価結果　ランク S (BEE_H:4.4)

評価建物の概要
- 建物用途：複合用途
- 所在地　：東京都港区
- 敷地面積：11,607 m²
- 延床面積：69,619 m²
- 階数　　：地下2階・地上56階
- 竣工　　：2004年3月
- 法定容積率：600%
- 実容積率　：599.8%
- 夏期卓越風向：南
- 空地率　：48.6%
- 地表面緑被率：24.3%

評価建物の特徴
(1)周辺環境、風通し　南からの卓越風を住棟間に導く計画とし、周辺の風通しに配慮している。(2)日陰　ペデストリアンデッキや庇、ステップガーデンに高木を植栽し、歩行者空間の日陰形成に努めている。(3)外構の地表面被覆　公園と一体化された空地には、積極的に樹木を植栽している。(4)建築外装材料　駐車場棟の積極的な植栽による立体的な緑のネットワークを形成している。(5)建築設備からの排熱　自然換気、コージェネの採用により効率的なエネルギー利用と、排熱を駐車場棟の屋上より排出している。



採点の考え方

評価分野	中項目	計画上の配慮事項
風通し	Q_H-1	南からの卓越風を住棟間に導く計画とする。
	LR_H-1	ビル風への配慮して建物の外観の角を丸める形態としている。
日陰	Q_H-2	ペデストリアンデッキや庇により日陰の形成に配慮するとともに、ステップガーデンに高木を植栽。
	LR_H-2	ペデストリアンデッキや庇により日陰の形成に配慮するとともに、ステップガーデンに高木を植栽。
緑地・水面の確保	Q_H-3	空地やステップガーデンに積極的に樹木を植栽。
	LR_H-3	緑化による効果
緑化	Q_H-4	人の出入りや各住戸からの見下ろし視線に配慮して駐車場棟に水平・垂直方向で連続する立体的な緑のネットワークを形成している。
	LR_H-4	駐車場棟の積極的な緑化
排熱位置等	Q_H-5	コージェネ機器の排熱は駐車場棟の屋上より排気
	LR_H-5	コージェネの採用により効率的なエネルギー利用を図る。排熱発生時間は住宅・非住宅部分の按分による。

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2. Site Coverage of Greenery

Overseas Examples:

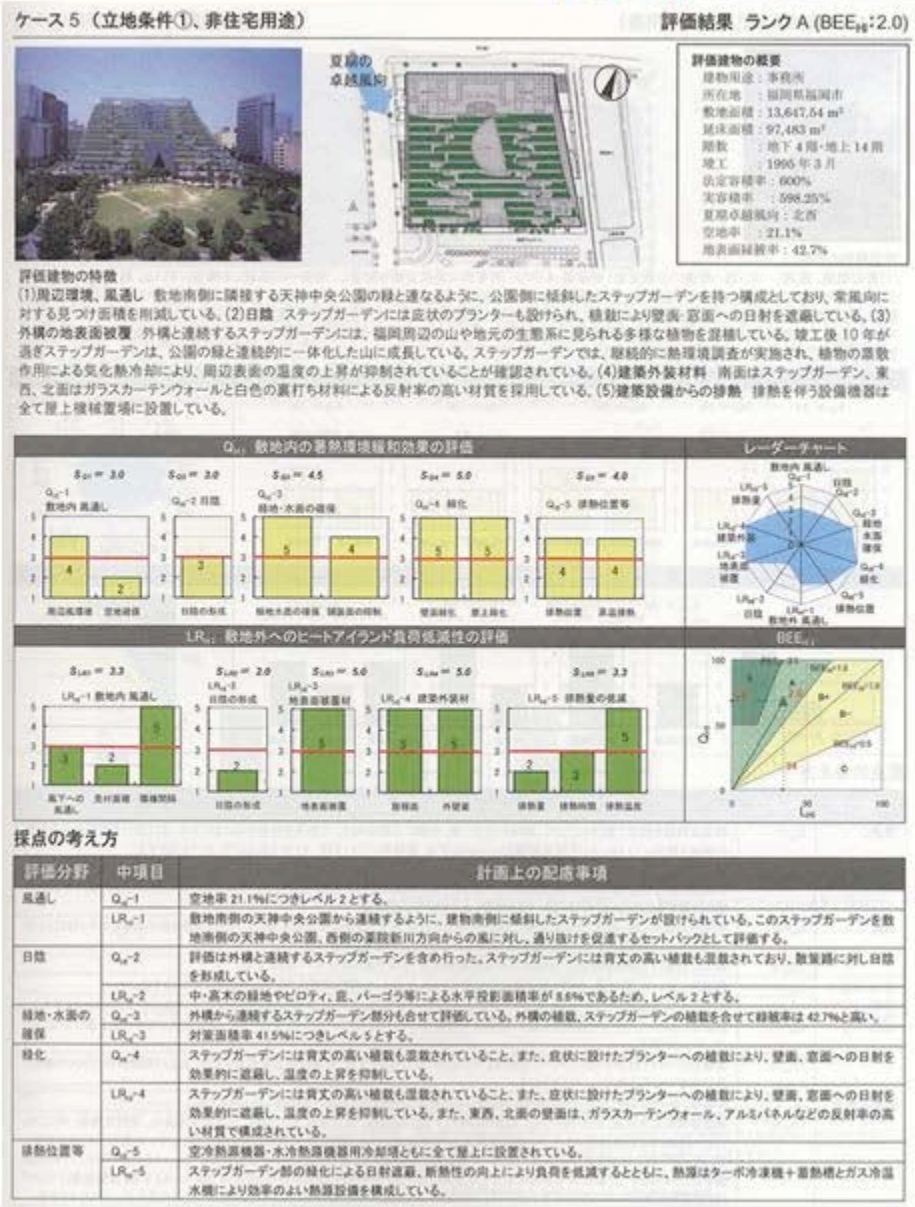
High-density commercial development in Fukuoka, Japan, with A-rating in CASBEE-HI assessment:

Site area – **1.16 ha**

Plot ratio – 6

Site coverage of greenery – **42.7%**

(Source: CASBEE-HI Tool-4 2006 by Institute of Building Environment and Energy Conservation, Japan)



ケース５（立地条件①、非住宅用途）　評価結果　ランクA (BEE$_{HI}$:2.0)

評価建物の概要
建物用途：事務所
所在地：福岡県福岡市
敷地面積：13,647.64 m²
延床面積：97,483 m²
階数：地下４階・地上14階
竣工：1995年３月
法定容積率：600%
実容積率：598.25%
夏期の卓越風向：北西
空地率：21.1%
地表面緑被率：42.7%

評価建物の特徴
(1)周辺環境、風通し　敷地南側に隣接する天神中央公園の緑と連なるように、公園側に傾斜したステップガーデンを持つ構成としており、卓風向に対する見つけ面積を削減している。(2)日陰　ステップガーデンには庇状のプランターも設けられ、植栽により壁面・窓面への日射を遮蔽している。(3)外構の地表面被覆　外構と連続するステップガーデンには、福岡周辺の山や地元の生態系に見られる多様な植物を混植している。竣工後10年が過ぎステップガーデンは、公園の緑と連続的に一体化した山に成長している。ステップガーデンでは、継続的に熱環境調査が実施され、植物の蒸散作用による気化熱冷却により、周辺表面の温度の上昇が抑制されていることが確認されている。(4)建築外装材料　南面はステップガーデン、東西、北面はガラスカーテンウォールと白色の裏打ち材料による反射率の高い材質を採用している。(5)建築設備からの排熱　排熱を伴う設備機器は全て屋上機械置場に設置している。

採点の考え方

評価分野	中項目	計画上の配慮事項
風通し	Q_{AE}-1	空地率21.1%につきレベル２とする。
	LR_{AE}-1	敷地南側の天神中央公園から連続するように、建物南側に傾斜したステップガーデンが設けられている。このステップガーデンを敷地南側の天神中央公園、西側の薬院新川方向からの風に対し、通り抜けを促進するセットバックとして評価する。
日陰	Q_{AE}-2	評価は外構と連続するステップガーデンを含め行った。ステップガーデンには背丈の高い植栽も混植されており、敷業路に対し日陰を形成している。
	LR_{AE}-2	中・高木の緑地やピロティ、庇、パーゴラ等による水平投影面積率が8.6%であるため、レベル２とする。
緑地・水面の確保	Q_{AE}-3	外構から連続するステップガーデン部分も合せて評価している。外構の植栽、ステップガーデンの植栽を合せて緑被率は42.7%と高い。
	LR_{AE}-3	対策面積率41.5%につきレベル５とする。
緑化	Q_{AE}-4	ステップガーデンには背丈の高い植栽も混栽されていること、また、庇状に設けたプランターへの植栽により、壁面、窓面への日射を効果的に遮蔽し、温度の上昇を抑制している。
	LR_{AE}-4	ステップガーデンには背丈の高い植栽も混栽されていること、また、庇状に設けたプランターへの植栽により、壁面、窓面への日射を効果的に遮蔽し、温度の上昇を抑制している。また、東西、北面の壁面は、ガラスカーテンウォール、アルミパネルなどの反射率の高い材質で構成されている。
排熱位置等	Q_{AE}-5	空冷熱源機器・水冷熱源機器用冷却塔ともに全て屋上に設置されている。
	LR_{AE}-5	ステップガーデン部の緑化による日射遮蔽、断熱性の向上により負荷を低減するとともに、熱源はターボ冷凍機＋蓄熱槽とガス冷温水機により効率のよい熱源設備を構成している。

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2. Site Coverage of Greenery

Overseas Examples:

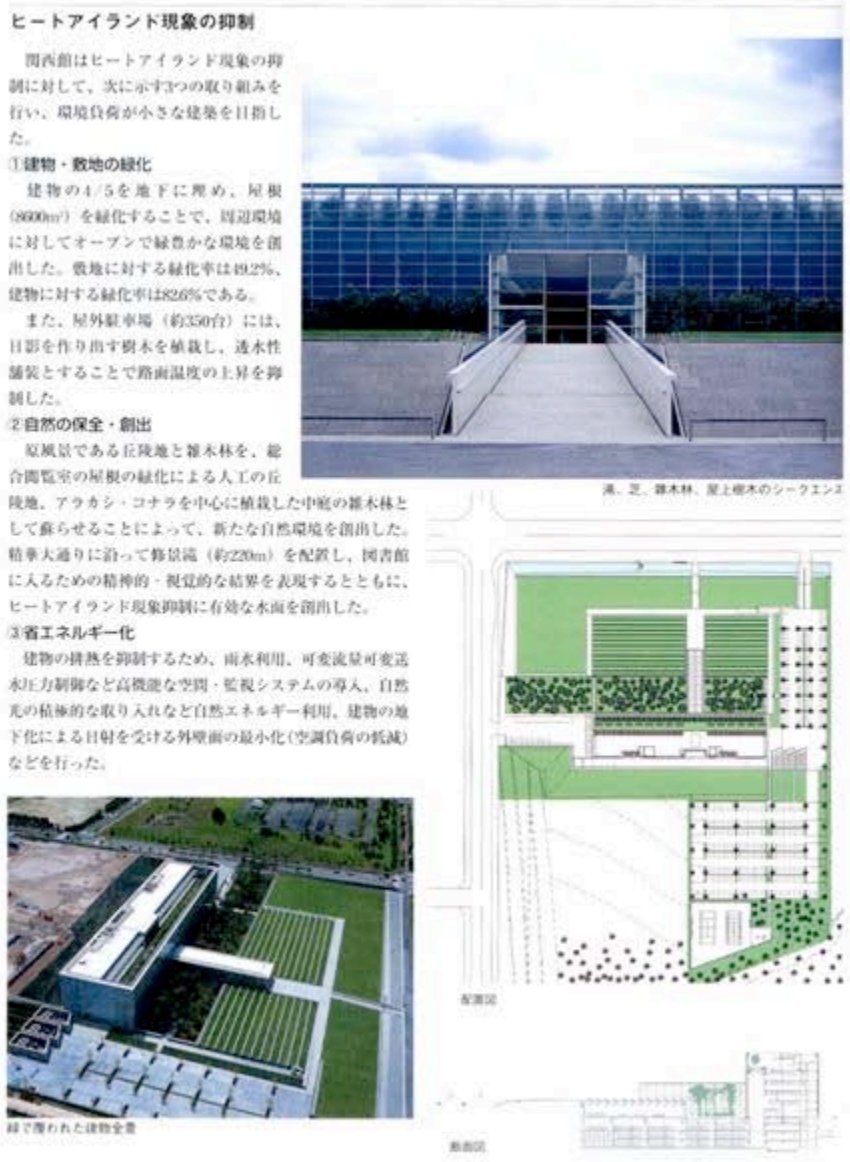
Library in Kyoto, Japan, with A-rating in CASBEE-HI assessment:

Site area – **5.9 ha**

Plot ratio – 1

Site coverage of greenery – **49.2%**

(Source: CASBEE-HI Tool-4 2006 by Institute of Building Environment and Energy Conservation, Japan)



ヒートアイランド現象の抑制

関西館はヒートアイランド現象の抑制に対して、次に示す3つの取り組みを行い、環境負荷が小さな建築を目指した。

①建物・敷地の緑化

建物の4/5を地下に埋め、屋根(8000m²)を緑化することで、周辺環境に対してオープンで緑豊かな環境を創出した。敷地に対する緑化率は49.2%、建物に対する緑化率は82.6%である。

また、屋外駐車場(約350台)には、日影を作り出す樹木を植栽し、透水性舗装とすることで路面温度の上昇を抑制した。

②自然の保全・創出

原風景である丘陵地と雑木林を、総合閲覧室の屋根の緑化による人工の丘陵地、アラカシ・コナラを中心に植栽した中庭の雑木林として蘇らせることによって、新たな自然環境を創出した。

精華大通りに沿って修景池(約220m)を配置し、図書館に入るための精神的・視覚的な結界を表現するとともに、ヒートアイランド現象抑制に有効な水面を創出した。

③省エネルギー化

建物の排熱を抑制するため、雨水利用、可変流量可変送水圧力制御など高機能な空調・監視システムの導入、自然光の積極的な取り入れなど自然エネルギー利用、建物の地下化による日射を受ける外壁面の最小化(空調負荷の低減)などを行った。

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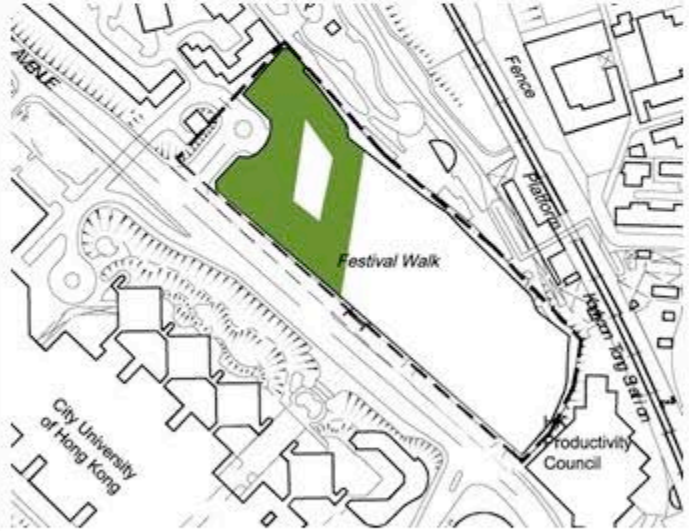
2. Site Coverage of Greenery

Local Case Study: Commercial / Mixed-use

Site: Festival Walk, Kowloon

Year of Completion: 1990s

Site Area (ha): **1.9**

Site Coverage of Greenery (recommended SC of Greenery ≥ 20%)	
Current Design	Possible Improvement
	
Almost 0%	**20%**

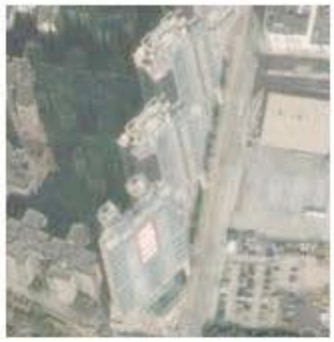
2. Site Coverage of Greenery

Local Case Study: Residential

Site: Manhattan Hill, Mei Foo

Year of Completion: 2000s

Site Area (ha): **1.3**



Site Coverage of Greenery (recommended SC of Greenery ≥ 20%)	
Current Design	Possible Improvement
	
15%	**20%**

2. Site Coverage of Greenery

Local Case Study: Residential

Site: Residential Development, Tung Chung

Year of Completion: 2000s

Site Area (ha): **7.5**

Site Coverage of Greenery (recommended SC of Greenery ≥ 30%)	
Current Design	Possible Improvement
	
26%	**30%**

2. Site Coverage of Greenery

Local Case Study: Public Housing

Site: Choi Wan Estate

Year of Completion: Tentative by 2010s

Site Area (ha): **3.0**

Site Coverage of Greenery (recommended SC of Greenery ≥ 30%)	
Current Design	Possible Improvement
	
19%	**30%**

2. Site Coverage of Greenery

Local Case Study: Institutional

Site: CityU AAB, Kowloon Tong

Year of Completion: Tentative by 2010s

Site Area (ha): **0.5**

Site Coverage of Greenery (recommended SC of Greenery ≥ 20%)
Current Design

45%

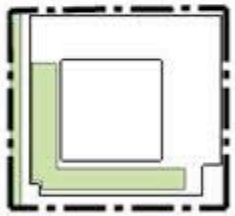
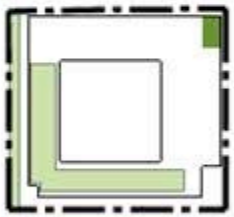
2. Site Coverage of Greenery

Local Case Study: Institutional

Site: Canossa Primary School, San Po Kong

Year of Completion: 2000s

Site Area (ha): **0.6**

Site Coverage of Greenery (recommended SC of Greenery ≥ 20%)	
Current Design	Possible Improvement
	
18%	**20%**

2. Site Coverage of Greenery

Local Case Study: Institutional

Site: Jordan Valley Primary School, Kwun Tong

Year of Completion: Tentative by 2010

Site Area (ha): **0.7**

Site Coverage of Greenery (recommended SC of Greenery ≥ 20%)	
Current Design	Possible Improvement
	
15%	**20%**

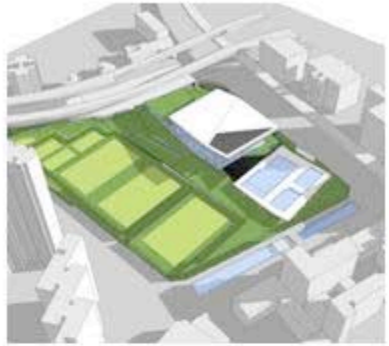
2. Site Coverage of Greenery

Local Case Study: Institutional

Site: Kwun Tong Swimming Pool, Kwun Tong

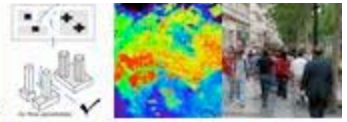
Year of Completion: Tentative by 2010s

Site Area (ha): **3.9**



Site Coverage of Greenery (recommended SC of Greenery ≥ 30%)		
Current Design	Possible Improvement	
		
15%	**30%**	**(Additional 9% greenery coverage, 5% water bodies & 1% vertical greenery [800m^2 x 0.5])**

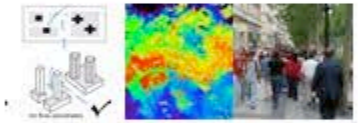
Recommendations of Study



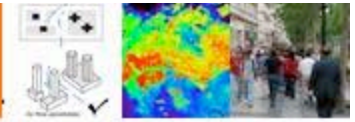
1. Building Separation / Permeability

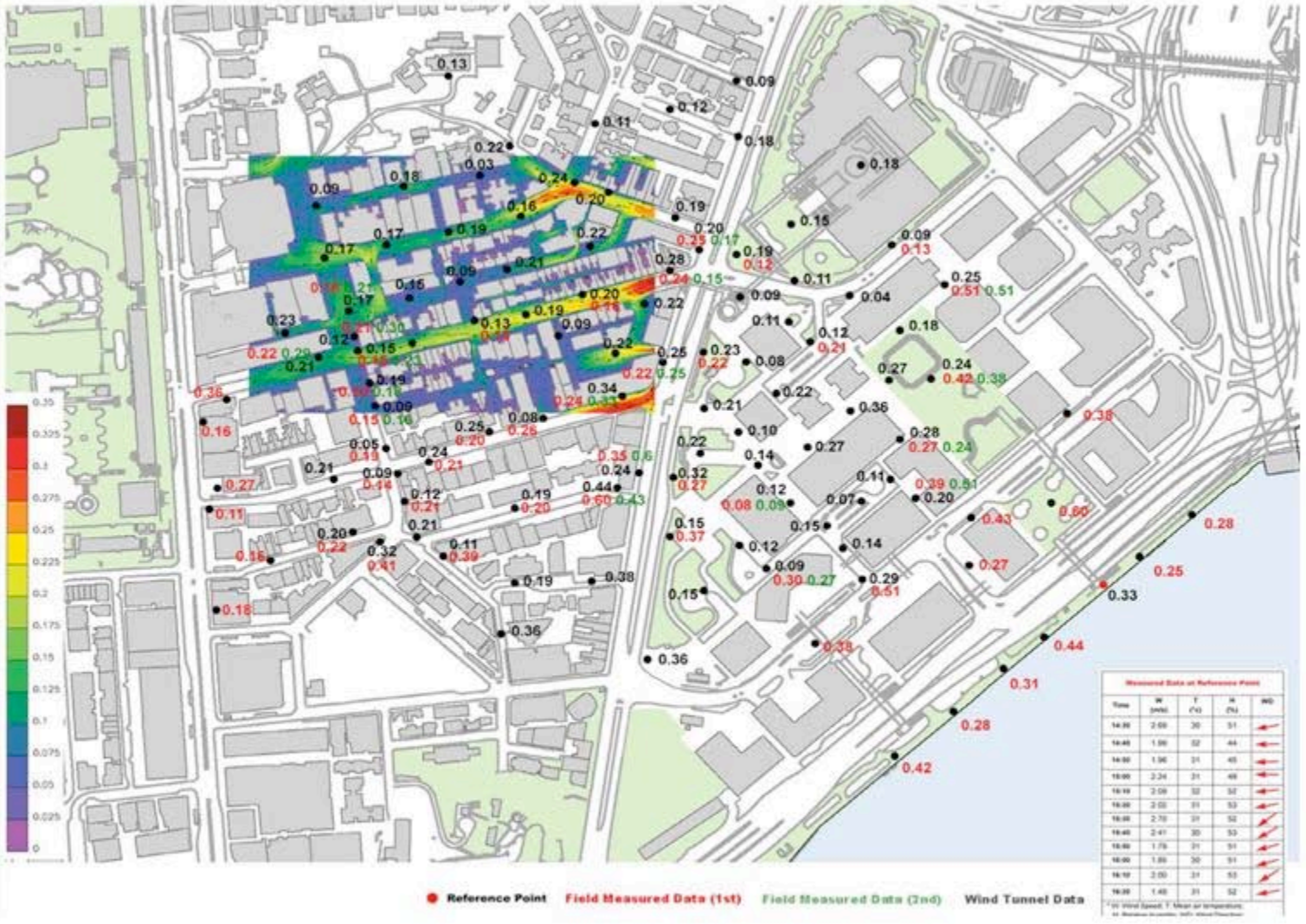
2. Site Coverage of Greenery

3. **Setback for Minimum Air Volume at Pedestrian Zone in Deep & Narrow Street Canyon**



Recommendations of Study





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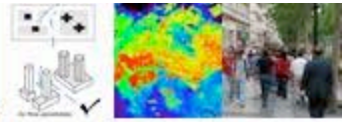
3.Setback for Minimum Air Volume at Pedestrian Zone in Deep & Narrow Street Canyon



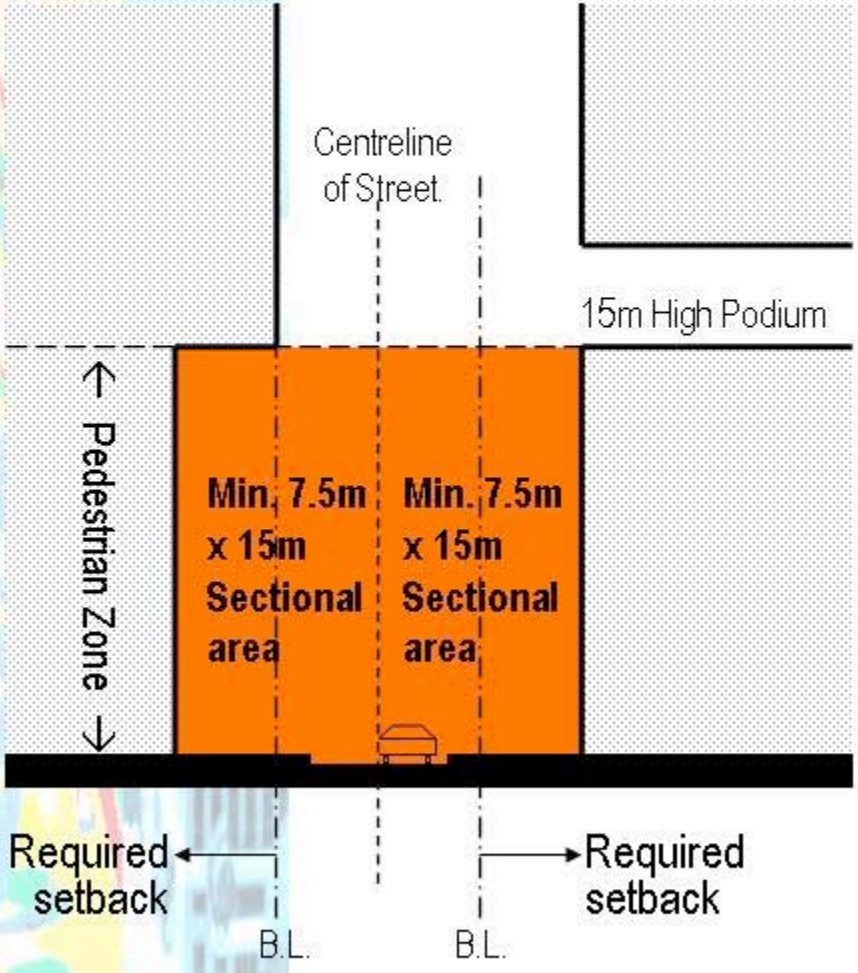
Recommendation:

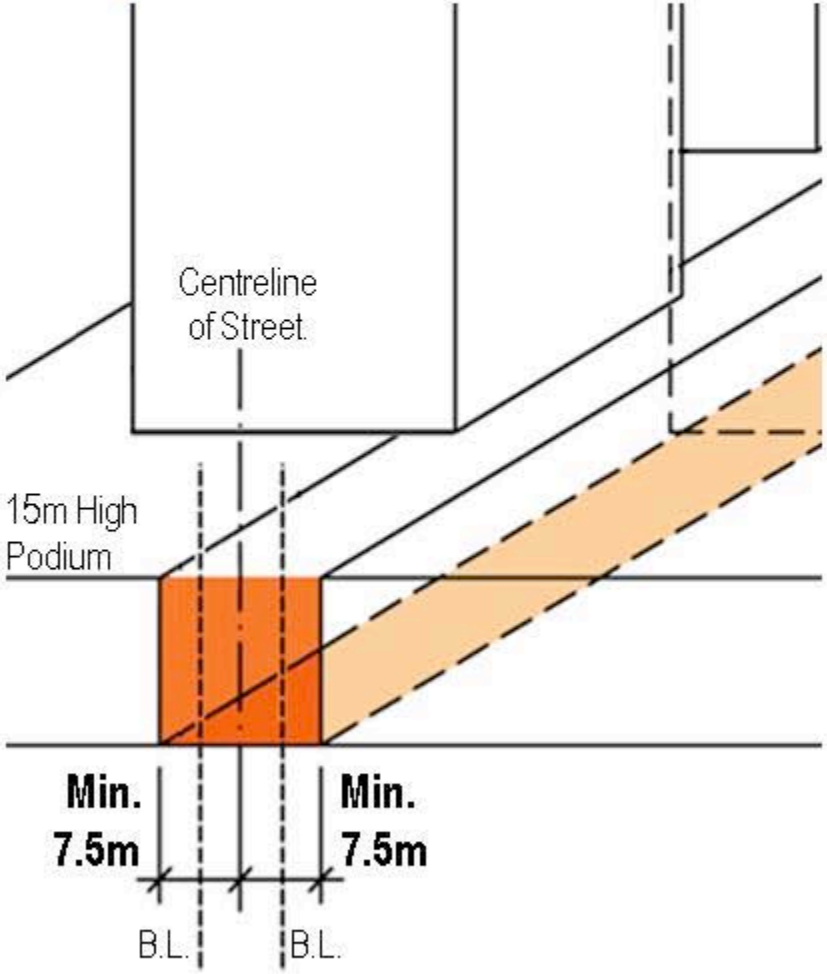
For site with depth ≥ 17.5m
min. setback of 7.5m
at Pedestrian Zone (0-15m)
for better air volume

[dimensions measured from **centreline of street**]

3.Setback for Minimum Air Volume at Pedestrian Zone in Deep & Narrow Street Canyon

Min. sectional area of urban canyon for better air volume at the Pedestrian Zone = **7.5m x 15m** or the equivalence





Public Engagement on Building Design to Foster a Quality and Sustainable Built Environment

20th June – 31st October 2009

Scope of this Public Engagement Exercise

This exercise focuses on the **design and layout of buildings** within their sites, and the impact they have on the quality and sustainability of the neighbourhoo

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Thanks…